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STRUCTURE AND TECTONICS FIELD TRIP TO THE EASTERN BLUE RIDGE AND WESTERN PIEDMONT NEAR MARTINSVILLE, VIRGINIA

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This road log and discussion of geology have been prepared for a 1-1/2 day field trip for the 30th Annual Virginia Field Conference, October 28 and 29, 2000, sponsored by the Geology Section of the Virginia Academy of Science. It will serve as a guide, however, to anyone interested in observing geologic features along or near the public roads in the area.

The 2000 Virginia Field Conference is in Franklin, Henry and Patrick Counties, Virginia where the Division of Mineral Resources mapped the Geology in detail in the late 1960s and early 1970s (Figure 1). The road log and stops are similar but not necessarily identical to the field trip prepared for the 5th Virginia Field Conference by Conley and Henika (1973b). Although there have been some changes made to update the geochronology and rock unit names presented in the 1973 Field Trip, the basic story the rocks tell in this area is unchanged after nearly thirty years of close scrutiny. The reports which cover the field trip area and contain detailed geologic maps in color on 7.5 minute topographic quadrangle bases, are available from the Virginia Division of Mineral Resources, Box 3667, Charlottesville, VA 22903 and are listed in the references section. Because of our continuing research and regional mapping since the 1960s, parts of these older reports have been revised. We also encourage you to obtain the following publications:

Publication 59, GEOLOGY OF THE SOUTHWESTERN VIRGINIA PIEDMONT, by J.F. Conley, 33 p. with one color map, 1985, Price $ 3.00.

Publication 137, GEOLOGY AND MINERAL RESOURCES OF HENRY COUNTY AND THE CITY OF MARTINSVILLE, VIRGINIA, by W. S. Henika, J.F. Conley, and P.C. Sweet, 22 pages, 15 figures, 2 tables, 2 maps, 1 in color, scale 1:50,000, 1996, Price $11.25.

The rocks to be examined are contained within three major regional structures, that are from west to east, the Blue Ridge anticlinorium, the Smith River allochthon, and the Sauratown Mountains anticlinorium (Figure 2). The trip is intended to be the second leg of a northwest to southeast transect across the crystalline thrust sheets of the Appalachian system in southwestern Virginia (Figures 16 & 17). The first leg was completed with the 27th Virginia Field Conference, (Henika, 1997b). That trip started in the Roanoke Valley on the Pulaski thrust sheet and crossed the Blue Ridge thrust on to the Fries thrust sheet along the eastern flank of the Blue Ridge anticlinorium, southeast of Roanoke. The last stops of the 1997 trip were intended to show the clastic metasedimentary and metavolcanic rocks near the base of the Lynchburg Group along the late Proterozoic rift in the eastern Blue Ridge (Henika, 1992, 1994, and 1997a). The 2000 Virginia Field Conference will start with the younger rift-related rocks in the Eastern Blue Ridge sequence of Virginia and traverse southeastwards across the Smith River allochthon to the Sauratown Mountains window along the Virginia-North Carolina Border. A third leg of this trans-Appalachian transect is in the planning stage for the 2001 SE GSA in Raleigh. It is intended to be a cooperative trip between Virginia Tech, NC State and UNC Chapel Hill and will visit the complex arc terranes on the Brookneal and Hyco thrust sheets in the Danville and Halifax areas southeast of Martinsville (Gates, 1981, Hibbard, and others, 1998).

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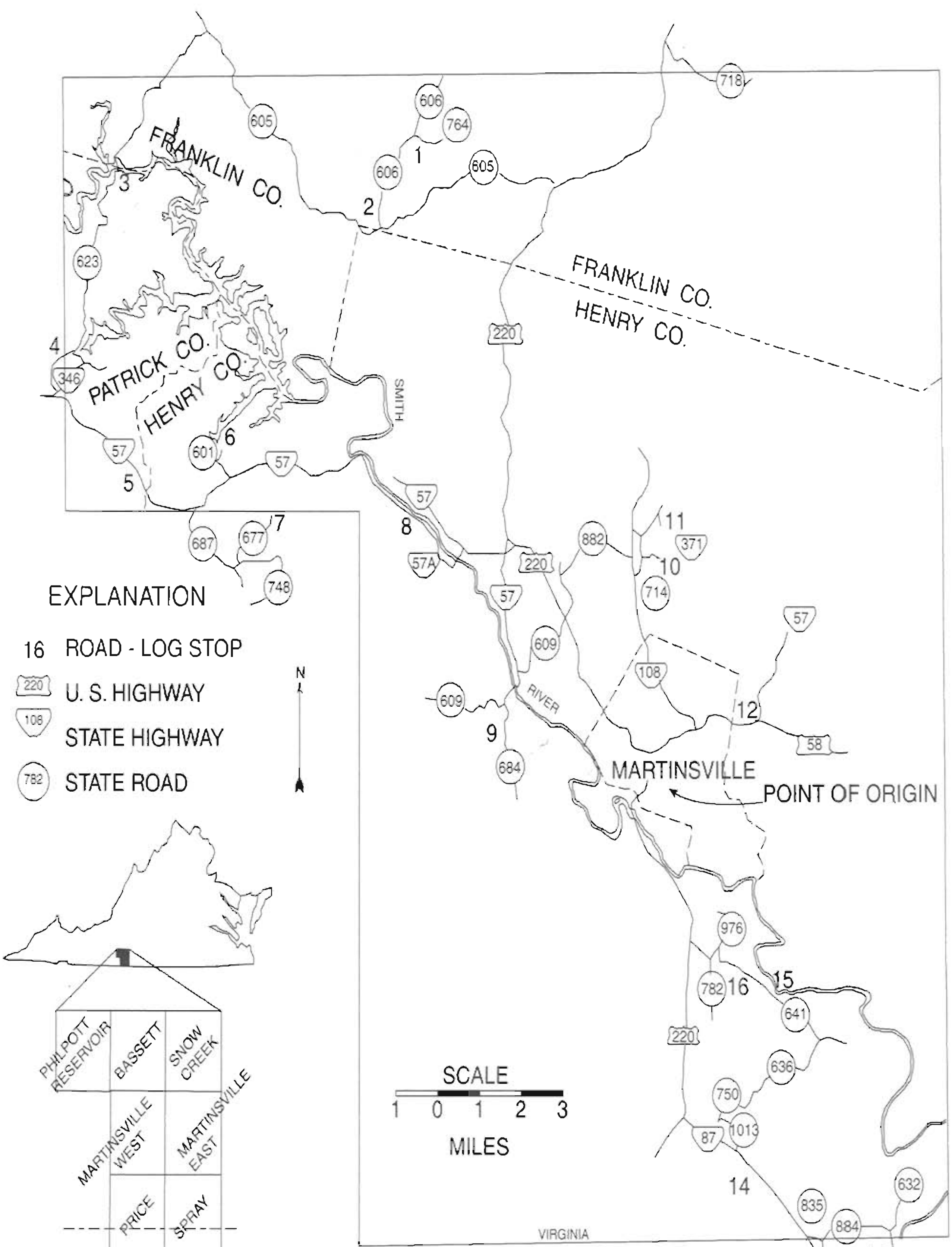


Figure 1. Map of the Martinsville area, Virginia showing U.S. and State Highways, State Roads, and location of stops along road-log route.

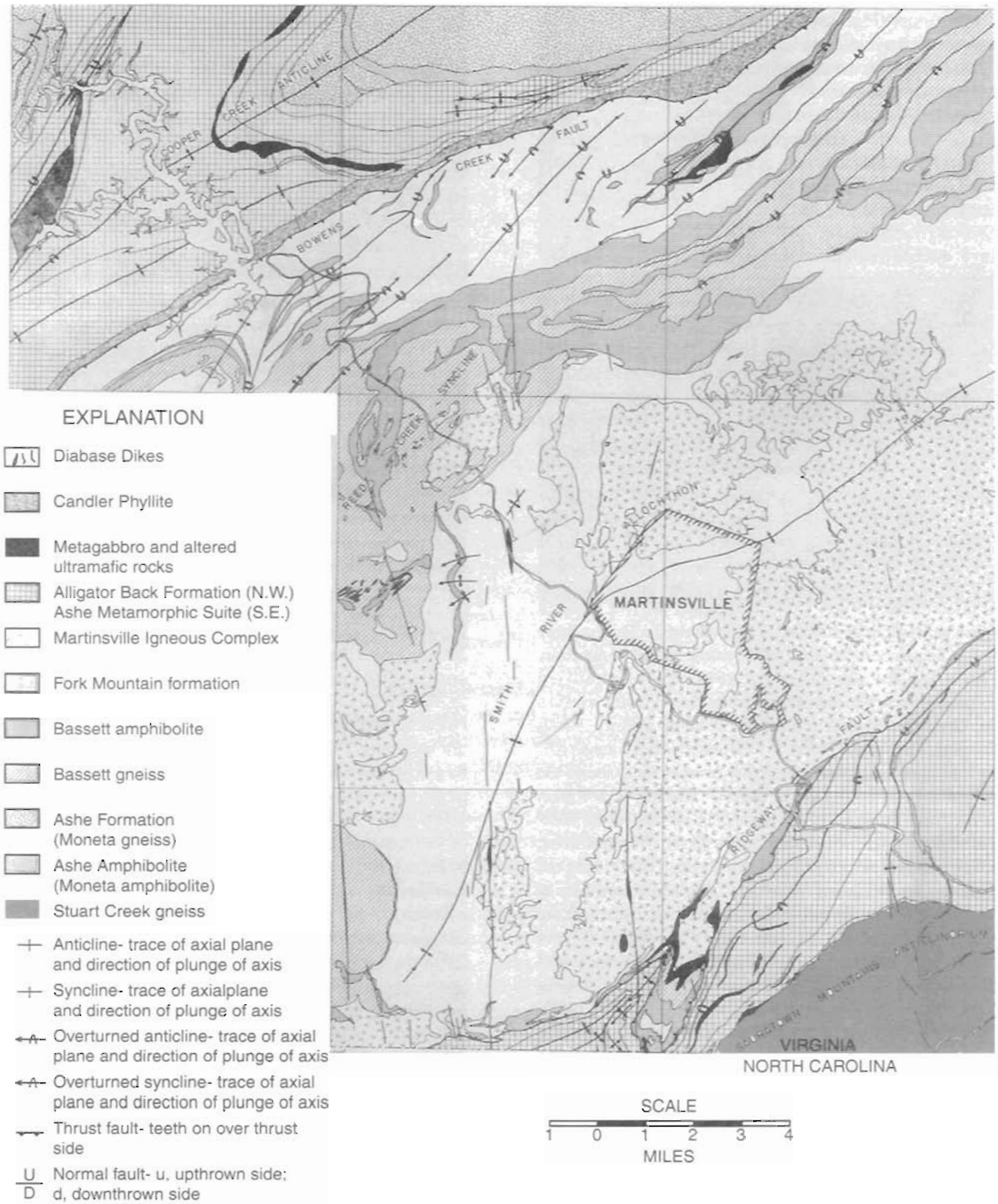


Figure 2. Major rock units and geologic structures, Martinsville area, Virginia.

BLUE RIDGE ANTICLINORIUM

The Blue Ridge anticlinorium in this area contains the rocks of the Red Valley thrust sheet (Figures 16 & 17; Henika, 1997, 2000). Basement rocks on the Red Valley thrust sheet that were covered in the 27th annual Virginia Field Conference are located southeast of the Late Proterozoic hinge line (Wehr and Glover, 1985). They represent portions of the Grenville (~1Ga) lower crust that were uplifted, eroded and eventually rifted during the two-stage (Badger and Sinha, 1988) Iapetan extensional event that had a principal axis of extension at ~N65W (Bartholomew, 1992, Henika, 2000). They typically have ductile mylonitic fabrics and upper greenschist metamorphic mineral assemblages that contrast with the well-preserved Grenville charnokite plutons and granulite gneiss metamorphic suite of the western Blue Ridge. Basement rocks on the Red Valley thrust sheet are very nearly identical to the Grenville units exposed in the Sauratown Mountains anticlinorium that we will visit on Sunday morning.

THE EASTERN BLUE RIDGE SEQUENCE: AN IAPETAN RIFT FACIES

Detritus from the Red Valley basement rocks was deposited in late Proterozoic sedimentary basins along the southeast margin of the Laurentian continent during the early opening of the Iapetus ocean basin. There are two rift-derived metasedimentary suites that accompanied the two volcanic episodes (Badger and Sinha , 1988) within the Eastern Blue Ridge Sequence. Rankin (1970) proposed the name Ashe Formation for the older rift sequence of stratified metasedimentary-metavolcanic rocks that directly overlies the Grenville basement complex in Ashe County, North Carolina. Rankin and others, (1973) assigned the younger rift-derived metasedimentary suite that overlies the Ashe to the Alligator Back Formation in the SW Virginia Blue Ridge. Conley and Henika, (1970) physically correlated the older Blue Ridge cover rocks in this area with the Moneta Gneiss, which was first described by Arthur Pegau (1932) along the Staunton River (Smith Mountain Lake area) northeast of Martinsville. Thus the name Moneta was used to describe the older rift sequence here on the 1973 Virginia Field Conference and the younger Iapetan rift sequence was correlated with the Lynchburg Formation by physically tracing these units to the type section in Lynchburg. Conley (1985), discontinued the use of the Moneta Gneiss and included the Ashe Formation as the lower member of the Lynchburg Group. He also discontinued the use of the Lynchburg Formation for the younger rift sequence and adopted the Alligator Back units from both NW and SE of the Bowens Creek fault as the upper group member.

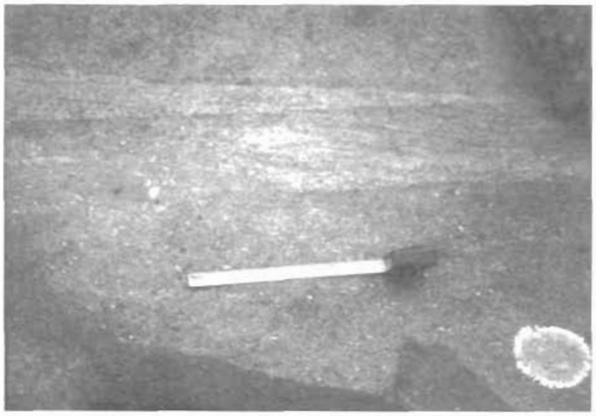
Discussion with several Carolina Geologists during the 1997 Field Conference raised some questions about the correlation of the basal Iapetan rift deposits (in the Lynchburg Group) along the Laurentian Continental margin with the Ashe Metamorphic Suite of western North Carolina. The Ashe that has been described southeast of the Brevard-Bowens Creek fault zone in North Carolina, is now thought to have been thrust in from much farther east across the Hayseville Fault. It has been grouped with suspect Piedmont terranes (Williams and Hatcher, 1982) thought to be part of an acreted oceanic plate. If the type Ashe was derived from across the Iapetus then perhaps the use of the original name Moneta Gneiss not only has precedence, but may be more appropriate than Ashe along the eastern limb of the Blue Ridge anticlinorium in Virginia.

The Ashe Formation (Moneta gneiss) is the oldest unit at the surface in the Blue Ridge anticlinorium in the road log area and consists of two-mica gneiss containing dark-gray to black and white, coarsely crystalline amphibolite interlayers, rare lenses of quartzite, mica schist and marble. The basal boulder conglomerate beds are restricted to the rift margin outcrop belt that we visited during the 27th Virginia Field conference and are not found this far to the southeast.

ASHE TO ALLIGATOR BACK TRANSITION

Rocks that were assigned to the Alligator Back Formation in the SW Virginia Blue Ridge (Rankin and others, 1973) were reviewed in the field with them during a series of joint USGS-VDMR field conferences in the early 1970's. At that time it became apparent that these rocks in SW Virginia were probably equivalent to units on both sides of the Bowens Creek Fault in central Virginia. Thus the Alligator Back, as it was originally recognized by the USGS included portions of the Evington Group of Brown, (1942 and 1958) as well as units found in the type section of the Lynchburg Gneiss formation of Jonas (1927). In the Field Trip area, the contact between the Ashe (Moneta) and the Alligator Back (Lynchburg) is a regional unconformity. The contact in the field trip area can generally be recognized where the monotonous series of amphibolite grade gneisses and schists of the Ashe (Moneta) is abruptly interrupted (cut by a paleo-channel?) by obviously lower grade metasedimentary rocks containing recognizable sedimentary clasts, graded bedding, cross bedding, cut and fill structures and graphite-bearing beds. Along Town Creek near Henry, **(Stops 1&2)**, the Alligator Back contains lithic conglomerate (especially near the base) (Figures 3and 4). Regionally the most widespread unit is medium to light-gray, finely laminated (pin striped) quartz-feldspar gneiss or metagraywacke with interbedded quartz- muscovite schist, graphite schist, (**Stop 3**, Figure 5) white-banded to massive quartzite **(Stop 4**, Figure 6) and rare marble lenses. Across the Philpott Reservoir quadrangle there are at least two major intervals of light green, to greenish gray schistose metavolcanic rocks in the Alligator Back that are thought to be the offshore equivalents to the Catoctin metabasalt flows of Central Virginia (Henika 1992, 1993, 1994). Conglomerates in the Alligator Back all seem to be of local derivation. The clasts are generally derived from underlying metasedimentary and metavolcanic rock units found in the Ashe Metamorphic Suite or older Alligator Back strata.

A



B

Figure 3. A- Metagraywacke ledge along Town Creek at stop 2. B-Detail of coarse metagraywacke showing cross bedding and scour structure.

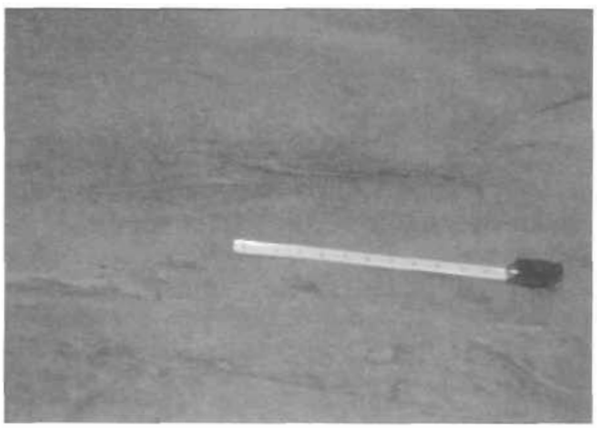


Figure 4. Deformed clasts in Alligator Back metagraywacke along Town Creek (Stop 2).

Figure 5. Flaggy Alligator Back graphitic meta-siltstone showing angular relationship between cleavage and bedding at stop 3.

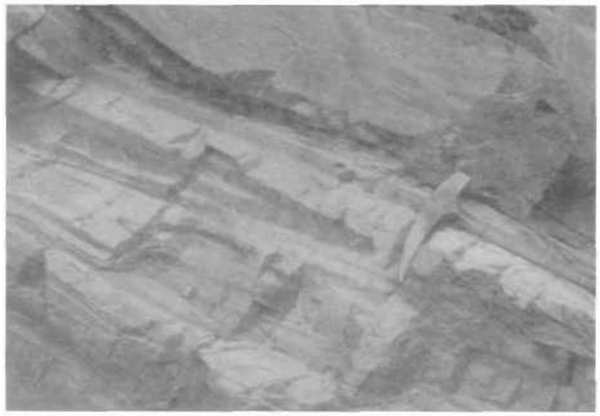


Figure 6. Detail of isoclinal fold in the Alligator Back quartzite at Stop 4 across from Fairystone Lake.

MAFIC IGNEOUS ROCKS IN THE ALLIGATOR BACK

The Alligator Back has been intruded by fine to coarse metagabbro (**stop 4**) and talc-tremolite rich dikes and sills throughout the region. The mafic igneous rocks appear to be localized along the contacts of schistose metasedimentary rocks near the base of the lower metavolcanic unit. Between stops 2 and 4, we will drive through typically deep red to greenish saprolite exposures of the Alligator Back metavolcanic rocks. They are complexly interlayered and interfolded with the Alligator Back metasedimentary rocks and the cross section of the Alligator Back exposed along Philpott Lake northwest of the Cooper Creek anticlinal axis appears to be predominately intermediate to mafic composition metavolcanic rocks. Magnetic Iron ore was mined from stratiform zones along the sheared plutonic and metavolcanic contacts in the Stuarts Knob area west of Fairy Stone Park (**Stop 3**).

CANDLER FORMATION AND THE BREVARD-BOWENS CREEK FAULT

Regional mapping in preparation of the Geologic Map of Virginia (VDMR,1993) traced the Bowens Creek fault zone continuously from the extension of the Brevard zone along the North Carolina Border (Espenshade and others, 1975) northeastwards into the Scottsville Mesozoic basin in Nelson and Albemarle Counties. This work reconfirmed Anna Jonas' (1927) placement of the " Martic Thrust" zone and demonstrated that the Brevard zone phyllonites could be traced into the type section of the Candler Formation on Candlers Mountain near Lynchburg. In the field trip area the Candler Formation conformably overlies the Alligator Back Formation. Along Philpott Lake there is a gradational contact between the Alligator Back and the Candler Formation that was mapped at the top of the upper most metagraywacke bed in the Alligator Back. Although there are thin quartzite and marble lenses in the Candler, dark-gray, graphitic schist appears to be restricted to the Alligator Back. At Stop 5 (Figure 7) on State Highway 57, it is typically a light greenish-gray to purplish-brown weathering chlorite phyllite. Intrafolial folds, kink bands and rotated choritoid porphyroblasts are typical of the Bowens Creek fault zone.

Figure 7. Detail of crenulated Candler phyllite in the Bowens Creek fault zone at Stop 5.

SMITH RIVER ALLOCTHON

The Smith River allocthon is interpreted as an alochthonous, synformal mass that tectonically overlies the James River synclinorium to the northeast. To the southwest it separates the Blue Ridge and Sauratown Mountains anticlinoria. The allochthon consists of a lower Bassett Formation (granitic gneiss containing amphibolite, **Stops 7&8,** Figures 8, 9, & 10) that is overlain by the Fork Mountain Formation (high alumina gneisses and schists containing interlayered quartzite, **Stops 6&9**). These rocks have been intruded by a large sill -like to slightly discordant, highly differentiated, predominately mafic igneous mass - the Martinsville Igneous Complex (Ragland, 1974). Conley and Henika (1973) recognized that the complex is composed of the Rich Acres Formation and the Leatherwood Granite (**Stops 10, 11&12**, Figure 11).

Figure 8. Steeply plunging antiformal fold in well-layered Bassett biotite-granitic gneiss at Stop 7.

Figure 9. Coarse porphyroclastic sillmanite-biotite gneiss in the top of the Bassett Formation along Mulberry Creek at Stop 7.

Figure 10. Pigmatically folded hornblende gneiss in the Bassett amphibolite at Stop 8.

The Martinsville Igneous complex is exposed along the southeastern margin of the allochthon and in several deep valleys in the central part of the synformal structure. Large scale excavations and water well drill hole data in the Martinsville area indicate that the major part of the Leatherwood Granite consists of sheets of light-gray, medium- to coarse-grained porphyritic biotite granite intruded as sheets at the top of the Martinsville Igneous

Figure 11. Leatherwood Granite cutting older gabbro of the Rich Acres Formation behind the Winn-Dixie at Stop 12.

Complex. Leatherwood Granite and associated Rich Acres Gabbro are cut by dikes and irregularly shaped plutons of dark gray, coarse-grained, porphyritic norite. The Leatherwood was dated at 450 Ma (U-Pb zircon; Rankin 1975); 464 ± 20 Ma (Rb-Sr whole-rock ; Odum and Russell, 1975); and 448 Ma U-Pb Zircon ; using SIMS high-precision technology (Sinha 1999, personal communication).

The high grade rocks of the allochthon show polyphase metamorphism. They have been prograded regionally to amphibolite facies reaching staurolite grade along the northwestern border and sillimanite grade to the southeast of this border (Figure 12). Following this event these rocks were partially to wholly retrograded to greenschist facies. During intrusion by the Martinsville Igneous Complex, contact metamorphism produced partial melt zones and converted the schists and biotite gneisses into migmatitic sillimanite gneisses, garnet-cordierite granulites and decussate-textured mica granofels. Granofels in contact metamorphic zones developed euhedral sillimanite, kyanite, and staurolite porphyroblasts near the intrusion and chloritoid porphyroblasts progressively further away from the contacts with the igneous body. Distinctive emery deposits (**Stop 16**, Figure 13) occur at the contact between the Martinsville Igneous Complex and the Fork Mountain metapelites. Emery here and elsewhere typically represents contact metasomatized aluminous schists or gneisses and contains assemblages including such minerals as sillimanite, corundum, Fe-Ti oxides (magnetite and ilmenohematite), Al-spinel, cordierite, garnet and hypersthene. The Martinsville emery deposits were prospected and mined at several localities on the Smith River allochthon and contain a distinctive metamorphic paragenesis also found at the Cortlandt Complex in New York (Conley and Henika, 1973a). One unique emery sample recently studied in detail by Beard and Tracy is oxide-rich, contains unusually abundant Th-rich monazite (REE phosphate) and zircon, and was previously prospected for thorium. Microprobe analyses of monazite in this sample for U, Pb and Th have been utilized in the new

Figure 12. Partially retrograded staurolite-mica schist in the Fork Mountain Formation along U. S. Highway 220 near Oak Level.

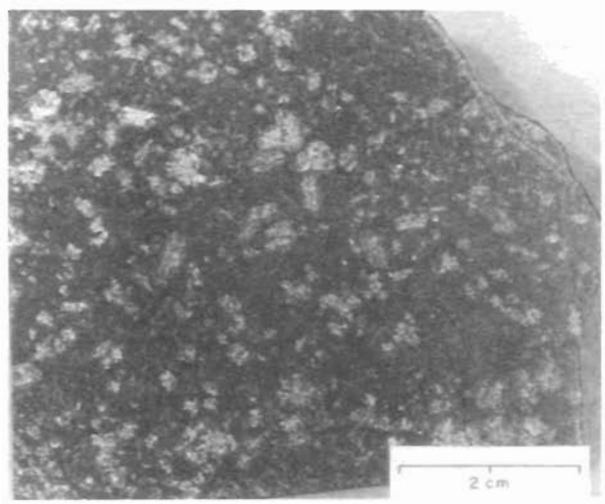


Figure 13. Sawed slab of spinel emery near Stop 16; dark minerals are magnetite, spinel (hercynite) and hoegbomite; light gray minerals are corundum and kyanite.

monazite chemical dating technique to produce a date of 435 ± 15 Ma for recrystallization of monazite in the contact event. This age is quite comparable to an age of 434 ± 17 Ma obtained for monazite from high-temperature contact metamorphosed migmatitic gneiss immediately adjacent to the gabbro just north of downtown Martinsville. Both monazite ages are considered equivalent, within error, to Sinha's recent 448 Ma SHRIMP age for the Leatherwood Granite.

SAURATOWN MOUNTAINS ANTICLINORIUM

The Sauratown Mountains anticlinorium lies in a structural block beneath the northwest dipping Ridgeway fault. The Ridgeway fault (**Stop 15**) is the detachment fault along which the Smith River allocthon was emplaced. In Virginia the Stuarts Creek Gneiss forms the core of the anticlinorium. It is composed of biotite augen gneiss **(Stop13)** with wide zones of flaser-textured mylonite gneiss concentrated along the Forbush fault zone (McConnell, 1988) and the Brookneal-Chatham fault zone (Henika , 1998). The Forbush forms the northwestern contact of the basement rocks in the anticlinorium and the Brookneal-Chatham fault zone forms the southeastern contact of the uplifted basement block along the northwest side of the Danville Triassic Basin. In addition to the main core area there are several tectonic slices of the Stuart Creek augen gneiss which were mapped by Van Price (1980) to the northeast of the field trip area. These rootless slices have been recently interpreted as part of a late Paleozoic transpressional duplex between the Forbush and Ridgeway fault zones (Henika, 1998).

The basement gneiss unit in the Sauratown Mountains anticlinorium of Virginia was named for the outcrops along Stuart Creek in the Spray quadrangle (**Stop 13**). Here it contains very coarse perthite porphyroclasts up to 4 cm across in a matrix of plagioclase, quartz, and biotite, with accessory titanite, epidote, hornblende, and opaque minerals. This rock was correlated with the Elk Park Group of the southwestern Blue Ridge by Espenshade and others (1975) and is very similar to coarse retrograde charnokite gneiss found to the northwest on the Red Valley thrust sheet (Figures 16 & 17; Henika, 1997, 2000). Rankin and others (1971) obtained a lead-lead zircon age of 1192 Ma from a layered biotite gneiss in a similar stratigraphic position to the Stuarts Creek in a quarry at Pilot Mountain, North Carolina, about 25 miles southwest of **Stop 13**.

Members of the Ashe Metamorphic Suite overlie the Stuart Creek Gneiss in the Sauratown Mountains anticlinorium. These units may not be in normal stratigraphic contact with the basement rocks. They include distinctive units of garnetiferous amphibolite, salt and pepper textured paragneiss (Figure 14), marble and garnetiferous mica schist (**Stops 14 and 15**). The mica schist units contain pristine porphroblasts of black, untwinned staurolite and large blades of kyanite (Conley and Henika, 1973). The distinctive prograde metamorphic assemblage of the Sauratown Mountains is different from the more complex, poly-metamorphic, sillimanite grade,

Figure 14. Complexly folded, northwest dipping, Ash Formation paragneiss and alaskite along the Ridgeway fault zone at Stop 15.

pelitic rocks of the overlying Smith River Allochthon. The rocks correlated with the Ashe metamorphic suite in the Sauratown Mountains anticlinorium may be part of the Laurentian continental margin isolated on a horse block beneath the Ridgeway fault or alternatively, they may be unique sequence of rift-related (?) late Proteozoic(?) clastic rocks and Grenville basement on an intermediate thrust sheet between the Smith River allochthon and the Bowens Creek fault (Hatcher and Others, 1989).

FIRST DAY OF FIELD TRIP

Point of origin: Virginia Museum of Natural History, 1001 Douglas Avenue, Martinsville, VA

Cumulative Mileage	Distance	Explanation
0	0	Starting point is the Virginia Museum of Natural History in Martinsville.
0.1	0.1	Turn Left on to Memorial Blvd. (U.S. Highway 220)
2.0	1.9	Cross Commonwealth Blvd.
3.3	1.3	Pass Dutch Inn on right.
4.8	1.4	Cross King's Mountain Road.
5.8	1.0	Turn Right on U.S. Highway 220 North toward Roanoke.
11.5	5.7	Cross county boundary from Henry into Franklin County.
13 3	1.8	Turn Left on State Road 605 (Henry Road).
17 7	4.4	Pass site of old Blue Ridge Paint Company talc quarry.
18.0	0.3	Turn right on State Road 606 (Town Creek Road, passing Henry Post Office).
18.5	0.5	Pass ledge in Town Creek.

18.6	0.1	Cross Town Creek.
19.1	0.5	Turn around at intersection between State Road 606 (Town Creek Rd) and State Road 767 (Prilliman Switch Road) and park on right shoulder of 606.

Stop 1. Ashe - Alligator Back Transition.

Park along south side of State Road 606 and walk back to amphibole schist and biotite-muscovite gneiss outcrops along State Road 606, north of the intersection. This is the top of the Ashe (Moneta) Gneiss mapped on the Bassett quadrangle (Henika, 1971). The base of the Alligator Back (Lynchburg) section is exposed in the cuts along SR 606 south of the intersection. The lower part of the Alligator Back consists of lenticular metagraywacke units which grade upward into mica schist units. These basal Alligator Back metagraywacke units appear to pinch out along strike around the Mill Creek anticlinal nose and their lower contact truncates units in the underlying Ashe (Moneta) suggesting a large scour channel at the top of the Ashe (Moneta) gneiss in the Bassett quadrangle (Henika, 1971, Figure 6). Large blocks of the amphibole gneiss were visible as clasts within the massive saprolite of the basal Alligator metagraywacke unit at this locality when the cuts were fresh (Henika, 1971, p. 15).

Cumulate Mileage	Distance	Explanation
19.1	0.0	Proceed to south along Town Creek Road.
19.6	0.5	Park on right shoulder for Stop 2

Stop 2. Alligator Back metaconglomerate.

The outcrop at stop 2 is a ledge in Town Creek. It involves a difficult descent to the waters' edge and only a few can see the outcrop at one time. Please be careful!

Coarse-grained, light-bluish -gray metaconglomerate interbeds in the lower Alligator Back along Town Creek contain graded beds with the basal laminae consisting of rounded blue quartz granules and cobble and pebble-sized rock fragments as much as 1 foot long. Microcline, perthite, plagioclase, muscovite biotite, secondary epidote, chlorite and titanite occur in the matrix and accessory zircon is concentrated in the interstices between the larger clastic particles.

Cumulate Mileage	Distance	Explanation
19.6	0	Proceed south along State Road 606 and Town Creek.
20.1	0.5	Turn right on State Road 605 proceed across railroad tracks at Henry.
26.4	6.3	Turn left at State Road 623 (Fairy Stone Park Highway).
29.8	3.4	Pass Ryans Branch Campground. Facilities available for a rest stop.
30.1	0.3	Cross Union Church Bridge over Smith River (Philpott Lake).
30.3	0.2	Park on right for Stop 3.

Stop 3 . Alligator Back metabasalt and graphitic metasedimentary rocks.

Walk down to the lake from the parking area near the west end of the bridge. Recent low water has exposed dark green amphibole schist and gneiss at the top of the lower Alligator Back metabasalt unit. This unit may be equivalent to a tongue of the Catoctin Metabasalt found at a similar stratigraphic position near Lynchburg (Henika, 1992,1997). Dark-gray to black metasiltstone and micaceous quartzite beds exposed in the road cuts above are diagnostic Alligator Back units in this area (Figure 5).

Cumulative Mileage	Distance	Explanation
30.3	0	Proceed south along State Road 623 towards Fairy Stone Park.
33.1	2.8	Mafic intrusive rocks in Alligator Back Formation exposed along road embankment out crops on right.
34.3	1.2	Turn left and park at Fairy Stone Lake boat launch area. Walk to southwest along left side of State Road 623 for Stop 4.

Stop 4. Alligator Back quartzite and metagabbro at Fairy Stone Lake.

Lenticular interbeds of white- to gray-layered quartzite are a diagnostic lithology for the Alligator Back Formation in southern Virginia. The quartzite bodies interbedded with dark, graphitic schist are thought to be deep water grain flow deposits off shore from beach or shallow water sand bodies along the Laurentian continental margin. Here the schist surrounding the quartzite beds has been intruded by coarse metagabbro of the Stuarts Knob mafic complex (Conley and Henika, 1970). The quartzite exposed at Fairy Stone Lake is one of several septa or roof pendants that are surrounded by mafic igneous rocks. Similar rocks correlated with the Mount Athos quartzite of central Virginia have been quarried commercially as "Virginia Log Stone" near Leesville in Campbell County. The gray banding in the quartzite at this stop delineates isoclinal fold hinges (Figure 6) that have been refolded around the larger regional fold axes. The quartzite here is very similar to the quartzite at Pilot Mountain, North Carolina.

Cumulative Mileage	Distance	Explanation
34.4	0.1	Return to State Road 623 and proceed south along lake shore.
35.1	0.7	Turn right on State Highway 346.
35.6	0.5	Turn left at State Highway 57 and continue to southeast.
37.1	1.5	Pass prominent outcrops of metagraywacke and quartzite interbedded in graphite mica schist.
38.0	0.9	Pull over to right shoulder to examine Candler Phyllite in the Bowens Creek fault zone. Drivers continue to park in picnic area.
38.3	0.3	Park at picnic area next to Haynes' 57 market.

Stop 5. Candler Phyllite and the Bowens Creek Fault Zone.

Drivers will discharge passengers along NE side of State Highway 57 and continue SE for 0.2 mile to parking area labeled "Fairy Stones Found Here" next to Haynes '57 market. Field trip group will examine mylonitic Candler Phyllite outcrops that are characteristic of the Bowens Creek fault zone (Figure 7), then cross the highway carefully and walk SE along the roadside. The contact will be found by noting the presence of deformed staurolite pseudomorphs in saprolite, soil and float in road cuts along the embankments of Highway 57. The weathered phyllite is in fault contact with the retrograded staurolite mica schist unit of the Fork Mountain Formation. This contact is subtle but consistently sharp for several tens of miles in either direction along strike (Figure 12). Well-preserved sericite pseudomorphs after staurolite can be collected only in the southeastern corner of Fairy Stone Park in the woods behind picnic table and sign.

Cumulative Mileage	Distance	Explanation
38.34	0.0	Proceed south along State Highway 57.
40.7	2.4	Turn left on State Road 601(Bowens Creek Road) and proceed to Bowens Creek Boat Ramp.
41.7	1.0	Park at ramp for Stop 6. Walk down to beach. From beach walk around point to ledges along lakeshore.

Stop 6. Fork Mountain mica schist containing altered staurolite and garnet.

The mica schist crops out as prominent ledges along the shoreline beyond the beach area at Bowens Creek Park. Large cruciform sericite pseudomorphs after staurolite are common porphyroblasts in the Fork Mountain mica schist along the hanging wall of the Bowens Creek fault zone for more than 18 miles to the southwest. Some very large crosses (2-3 inches) have been found here. Be sure to look at rock slabs and flakes in the water along shore for nice hand specimens.

Cumulative Mileage	Distance	Explanation
41.7	0	Proceed back to State Highway 57 via State Road 601.
42.5	0.8	Turn right on State Highway 57.
43.7	1.2	Turn left on State Road 687.
44.2	0.5	At intersection with State Road 912 take State Road 687 to left.
45.7	1.5	Turn left on State Road 677.
47.0	1.3	End State Maintenance Sign, continue down to Hollingsworth Mill site.
47.2	0.2	Turn around at fork in dirt road and park vehicles headed up hill. Follow leaders down dirt path to monument for discussion of Stop 7.

Stop 7. Bassett Gneiss at the Hollingsworth Mill site

Start traverse along Blackberry Creek below falls. The gneiss outcrops are in the central portion of a dome-shaped fold. surrounded by the Fork Mountain schist (Henika, and others,1996). The rock ledges below the falls are at the very top of the Bassett Formation.. The mafic metavolcanic units (amphibolite and amphibole gneiss) which commonly occur along the Bassett-Fork Mountain contact are not present in this area along Blackberry Creek. Coarse micaceous gneiss with porphyroclasts above the falls may be in the base of the overlying Fork Mountain Formation, which is exposed as saprolite along the road.

Bassett biotite-granitic gneiss crops out in well-layered ledges below the falls. The granitic gneiss shows numerous small scale structures, including steeply plunging asymmetric folds in the layering (Figure 8). Blocks and pavements in and above the falls have abundant almond to walnut-sized white (sillimanite-quartz-k-feldspar) porphyroclasts (Figure 9). These porphyroclasts are crowded together in beds along the gneissic foliation. They resemble the recrystallized lithophysae described by Rankin in the White Top Rhyolite Member of the Mount Rodgers Formation (Rankin, 1993, Figure 5). An alternative protolith might have been a melange unit with lithic clasts that were washed into a back arc basin from felsitic volcanic units of the arc complex mapped in the Danville quadrangle (Milton Belt) to the east (Henika, 1975, 1977, 1994, Figures 27c&d).

Cumulative Mileage	Distance	Explanation
47.2	0	Proceed back to State Road 677.
47.5	0.2	Begin pavement on State Road 677.
48.8	1.4	Turn right on State Road 687.
50.3	1.5	At intersection with State Road 912 take State Road 687 to right.
50.8	0.5	Turn right on State Highway 57.
51.9	1.2	Pass Bowens Creek park sign on left
55.4	3.5	At intersection with State Highway Alternate 57 bear right (Alternate 57)
55.7	0.3	Pass Bassett Gneiss outcrop in cut to right of sidewalk.
56.6	0.9	Cross State Road 698 at stop light.
56.7	0.1	Turn left into Bassett Rescue Squad Parking Lot for Stop 8 discussion.

Stop 8. Bassett Amphibolite: Park in Rescue squad lot, being careful not to block emergency vehicles.

Discussion in parking area. Then carefully cross State Highway 57 to examine ptigmatically folded hornblende gneiss outcrops (Figure 10). Dark-greenish gray, medium-grained, well foliated amphibolite and hornblende gneiss crops out south of the Smith River along the bluffs in the type area of the of Bassett Formation (Conley and Henika, 1993). Henika, (1971, p.7) described coarse granoblastic metamorphic rocks containing bright green pleochroic pyroxene and red garnet in the Bassett. These anomalous granulites are lithologically similar to the altered eclogites described in the Ashe metamorphic suite in North Carolina.

Cumulative Mileage	Distance	Explanation
56.7	0	Turn left on to StateHighway 57 and proceed to the southeast.
59.3	2.4	Turn right on southbound ramp to U.S. 220 Bypass.
61.1	1.9.	Take off ramp to intersection with State Road 609.
61.2	0.1	Turn left on to State Road 609.
61.4	0.2	Pass cut exposing Fork Mountain Gneiss on Left .
62.4	1.0	Turn right on State Road 684 (Carver Road).
63.0	0.6	Turn right into Boxley Aggregates Martinsville Stone Quarry and park.
63.5	0.5	Follow company guide along haul road to quarry area for Stop 9.

Stop 9. Boxley Aggregates Martinsville Quarry.

At this locality Boxley Aggregates is mining the garnetiferous biotite gneiss of the Fork Mountain Formation (Figure 15). The garnetiferous biotite gneiss is light-to dark-gray compositionally banded, rudely foliated, fine- to coarse-grained, porphyroblastic metamorphic rock. Coarse clots of sillimanite, garnet, and cordierite and melt zones containing refractory quartzite and amphibolite xenoliths are common along contacts with the Martinsville Igneous complex. Metagabbro of the Martinsville Igneous Complex has been exposed in the lower levels of the mine.

Figure 15. Garnetiferous biotite gneiss of the Fork Mountain Formation in the Boxley Aggregates Martinsville Quarry.

Cumulative Mileage	Distance	Explanation
63.5	0	Retrace the route to the mine entrance.
63.6	0.1	Turn left on State Road 684 (northeastward).
64.3	0.7	Turn right on to State Road 609.
64.8	0.5	Cross the Smith River and turn left on State Highway 57.
65.0	0.2	Turn right on State Road 609 (Daniels Creek Road).
67.0	2.0	Cross U.S. Higaway 220.
67.8	0.8	Turn right on State Highway 174 (Kings Mountain Road).
70.0	2.2	Turn right on State Highway 108 .
70.5	0.5	Turn left on State Highway 371 (College Road).
71.1	0.6	Turn right at entrance to Patrick Henry College (Patriot Avenue).
71.7	0.6	Turn right into parking area across from Walker Hall for Stop 10.

Stop 10. Norite of the Rich Acres Formation on the campus of Patrick Henry College.

Spheroidal weathered boulders of sub-ophitic to porphyritic, augite-biotite-hypersthene-labradorite norite, a late phase of the Rich Acres (*Note: These rocks are part of the landscaping for the campus and hammers should be left in the vehicles!)*

Turn around and continue westward on State Highway 371 (Patriot Avenue).

Cumulative Mileage	Distance	Explanation
71.8	0	Retrace route via State Road 371.
72.4	0.6	Turn right on State Road 714
72.7	0.3	Turn right on State Road 1190.
73.2	0.5	Turn right through gate to park area on Martinsville Reservoir.
73.5	0.3	Turn around at lakeshore and drive back past granite outcrops on embankment.
73.6	0.1	Park on right for Stop 11, Rest rooms ahead on right.

Stop 11. Leatherwood Granite outcrops at Martinsville Reservoir.

The Leatherwood here is a coarse to medium grained porphyritic biotite-plagioclase-microcline granite. Phenocrysts are microcline and may show rapakivi texture. Rock generally shows some granulation around grain boundaries. The Leatherwood weathers to a light-pinkish-gray saprolite and forms well- drained, light-tan to red sandy soils. From rest area proceed to Martinsville Reservoir access road.

Cumulative Mileage	Distance	Explanation
73.7	0.1	Turn left on State Road 1190 and proceed back to State Road 714.
74.3	0.6	Turn right on State Road 714.
74.5	0.2	Pass entrance to Patrick Henry College on left.
75.2	0.7	Turn left on State Highway 174 (Kings Mountain Road).
77.1	1.9	Turn left on to Clearview Drive.
77.2	0.1	Turn right on Northside Drive.
77.9	0.8	Turn left on to Commonwealth Drive.
78.3	0.4	Turn right on exit to Fairy Street but continue directly across Fairy onto Hooker Street.
78.6	0.3	Turn left on Chatham Road.
78.7	0.1	Bear to right to follow U.S. Highway 58E (Church Street) towards Danville.
80.0	1.3	Turn left on to State Highway 57E.
80.1	0.1	Park vehicles in side lot at Winn-Dixie shopping center by the Leatherwood Wash and Dry for Stop 12.

Stop 12. Leatherwood Granite intruding metagabbro in the Martinsville Igneous Complex.

Discussion will be held in parking lot beside the Winn-Dixie store, then group should follow leaders around to back of store in the Winn-Dixie loading area to see fresh exposures of the Leatherwood Granite cutting the older Rich Acres Metagabbro member of the Martinsville Igneous Complex (Figure 11).

End of First Day. Vans will return to The Virginia Museum of Natural History in Martinsville.

SECOND DAY OF FIELD TRIP

Point of origin: Virginia Museum of Natural History, 1001 Douglas Avenue, Martinsville, Virginia.

Cumulative Mileage	Distance	Explanation
0	0	Starting point is the Virginia Museum of Natural History in Martinsville
0.1	0.1	Turn right on to Memorial Blvd.(U.S. Highway 220)
1.1	1	Cross the Smith River.
2	0.9	Pass Food Lion on right, site of good Rich Acres Metagabbro exposures.
3.4	1.4	Pass Martinsville Speedway on left.
4.4	1.0	Cross U.S. Highway 56 By-pass.
6.8	2.4	Turn left on to U.S. Highway 220 S. Business.
7.6	0.8	Turn left on to State Highway 87.
11.0	3.4	Turn Left on State Road 835 (Doyle Road).
11.4	0.4	Turn Left on State Road 884 (Powell Road).
13.2	1.8	Turn left on State Road 632, cross Stuart Creek and park on right.

Stop 13. Stuart Creek Gneiss in the core of the Sauratown Mountains anticlinorium.

Large boulders of the coarse granitic augen gneiss are exposed along the channel of Stuart Creek northeast of the intersection of State Roads 884 and 632. This unit is typical of the core structure of the Sauratown Mountains anticlinorium. The unit is much more mylonitic along the contacts with the overlying Ashe Metamorphic Suite (Forbush fault zone) to the northwest and along the Triassic contact to the southeast (Chatham-Brookneal fault zone).

Cumulative Mileage	Distance	Explanation
13.3	0.1	Turn around, turn right on to State Road 884
15.2	1.9	Turn right on State Road 835
15.7	0.5	Turn right on State Highway 87
17.5	1.8	Park on right shoulder for Stop 14

Stop 14. Garnet mica schist and hornblende gneiss along the Forbush Fault zone.

The mica schist and amphibolite exposed in a cut along State Highway 87 was correlated with the Alligator Back Formation in the Blue Ridge by Conley (1985). This correlation may be uncertain because there are similar units mapped in the Ashe metamorphic suite. Interlayers of garnetiferous hornblende gneiss and this garnetiferous mica schist directly overlie the sheared Sauratown basement rocks along State Highway 87 in this part of the Spray Quadrangle (Henika and Algor, 1972). All the contacts within the Sauratown Mountains cover sequence are highly sheared and could be faults. Abundant garnets, large kyanite blades and black prismatic staurolite crystals that occur in the red micaceous clay soil on the hill just west of this exposure are diagnostic of this unit.

Cumulative Mileage	Distance	Explanation
17.5	0.0	Proceed north on State Highway 87.
18.2	0.7	Turn right on to State Road 1013.
18.8	0.6	Turn right on to State Road 750.
19.5	0.7	Turn left on State Road 636.
21.8	2.4	Turn left on to State Road 642 to Eggleston Falls.
23.1	1.3	Park on shoulder before bridge over Marrowbone Creek for Stop 15.

Stop 15. Ridgeway Fault zone.

Walk across bridge over Marrowbone Creek and follow fisherman's trail down to riverside. Contorted layers of the Sauratown Mountain Ashe Metamorphic Suite form the ledges just upstream of the confluence of Marrowbone Creek and Smith River (Figure 14). These include medium-bluish- gray muscovite-biotite gneiss and sparkling- silver-gray garnet-muscovite schist injected by coarse alaskite sills. Farther upstream, highly deformed garnet-mica schist is exposed along the dirt track. Farther along the riverside we will also traverse across ledges of crushed and sheared alaskite, and garnetiferous hornblende schist and gneiss. The last accessible ledge we will see at the point of rocks is a slice of the Bassett Amphibolite (no garnets) along the Ridgeway Fault from near the base of the Smith River Allochthon.

Cumulative Mileage	Distance	Explanation
23.1	0	Walk back to vehicles. Proceed north on State Road 642.
23.5	0.4	Park along road for Stop 16.

Stop 16. Kyanite-Magnetite Granofels, Emery and Monazite Deposits of the Smith River Allocthon.

The wooded knob at this locality is underlain by an intensely sheared emery deposit along the contact metamorphic zone between the Martinsville Igneous Complex and the Fork Mountain Formation.. The emery was prospected and mined at several localities in the Martinsville area. It is most commonly found as dark greenish-gray to-black, granular aggregates of corundum, magnetite and spinel (Figure 13). Dark-green hercynite (spinel) is rimmed by brown hoegbomite in a distinctive metamorphic paragenesis similar to that described from Pittsylvania County (Watson, 1925) and from the Cortlandt Complex , New York (Friedman, 1956.) The isolated concentrations of highly magnetic minerals produce a characteristic "curly maple pattern" on regional aeromagnetic surveys. One of the isolated deposits, described by Mertie (1955) as "fossil monazite placer" consists of approximately 60 % magnetite (intergrown with other opaque minerals), 25% quartz, 10% kyanite, 2% monazite, and traces of corundum, sillimanite, zircon and hematite. (Conley and Henika, 1973A, p. 56-60). Monazite from this locality has recently been dated by Tracy and Beard at 435 ± 15 Ma, using the newly developed microprobe technique for U-Th-Pb chemical dating of monazite.

End of second day. Vans will return to Museum of Natural History in Martinsville.

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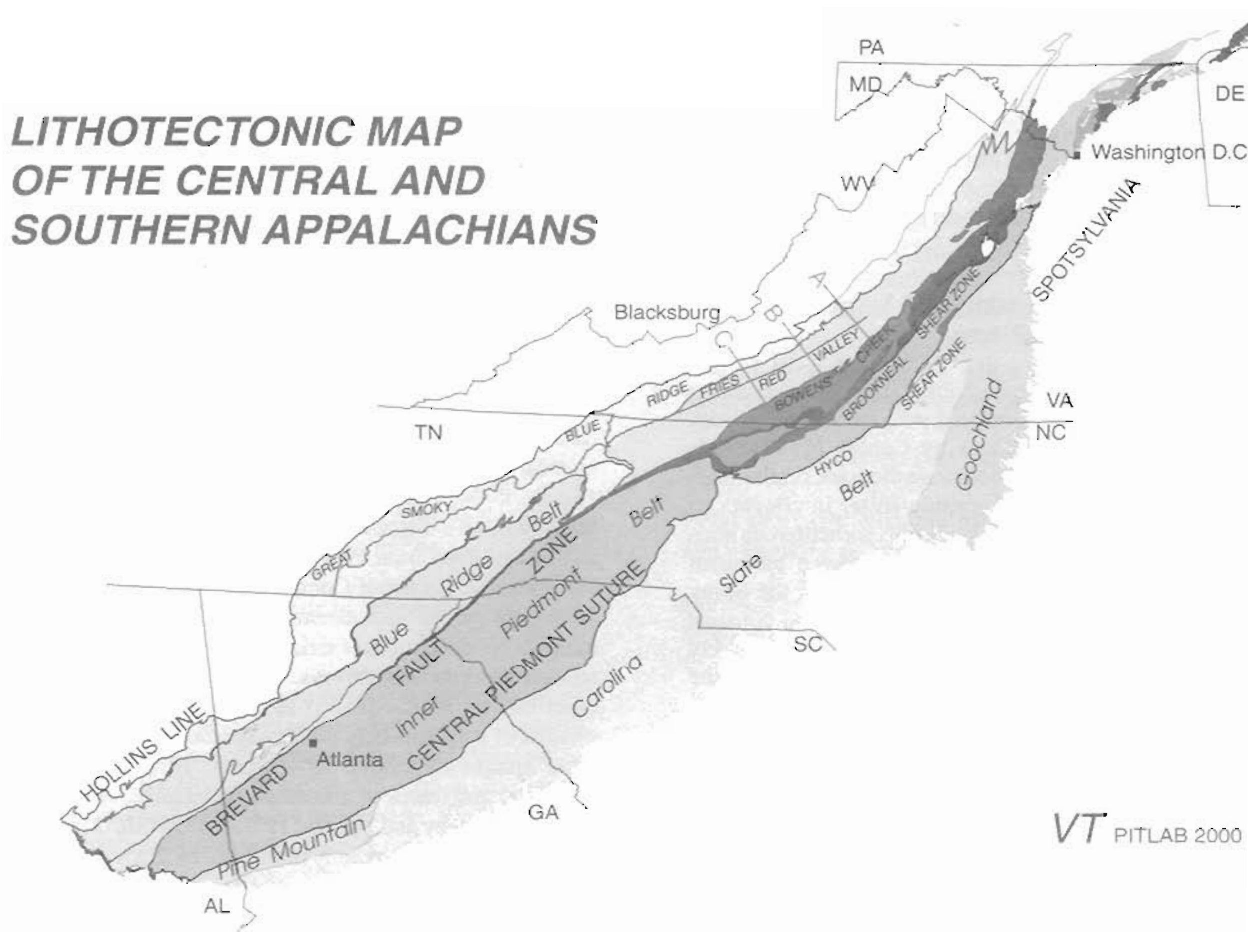

Figure 16. Lithotectonic map of the Central and Southern Appalachians showing locations of regional cross sections.

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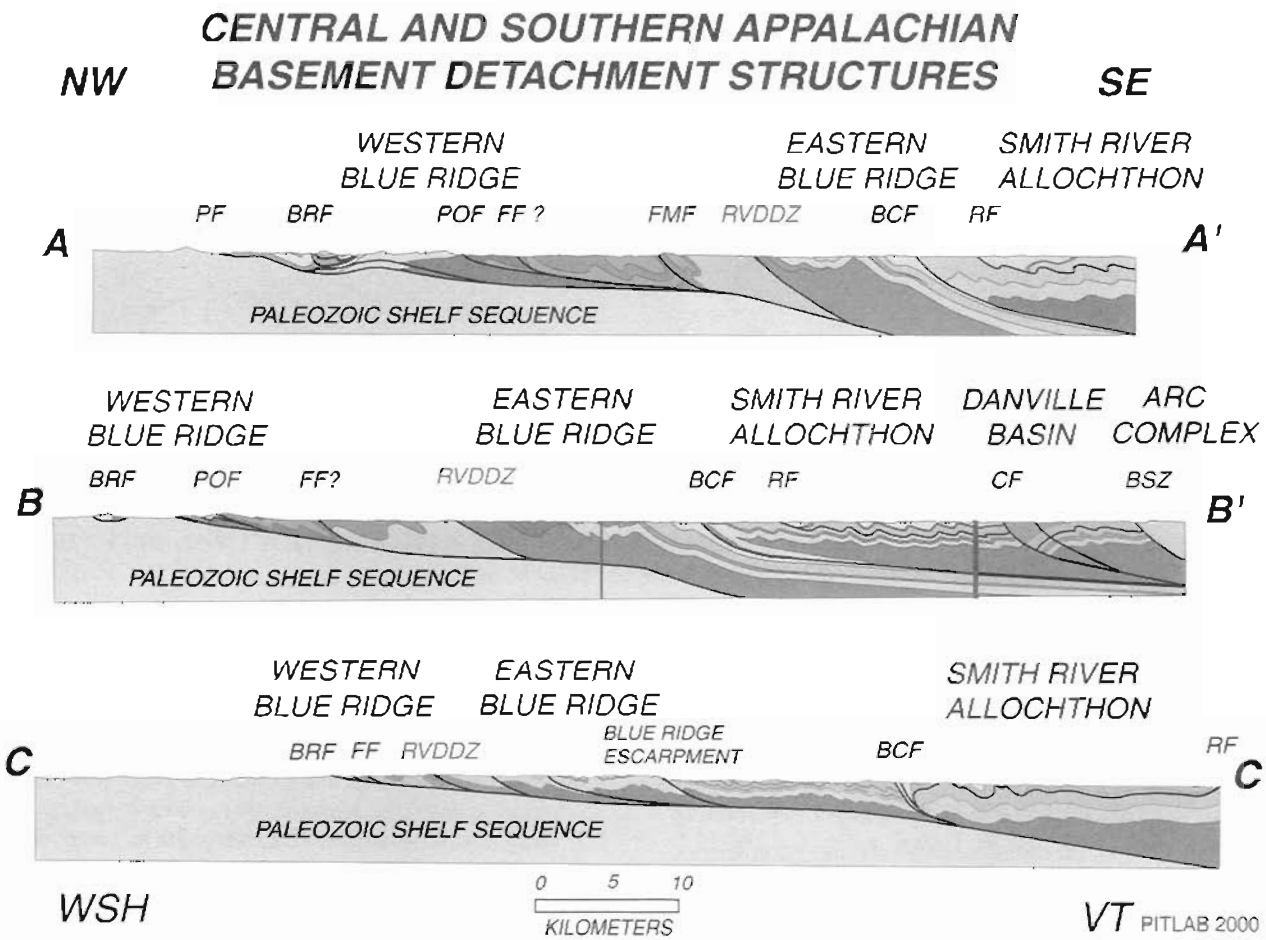

Figure 17. Regional cross sections showing Central and Southern Appalachian basement detachment structures. This field trip area lies midway between cross sections B-B' and C-C'. PF = Pulaski fault, BRF = Blue Ridge fault, POF = Peaks of Otter fault, FF = Fries fault, FMF = Fleming Mountain fault, RVDDZ = Red Valley ductile deformation zone, BCF = Bowens Creek fault, RF = Ridgeway fault, CF = Chatham fault, BSZ = Brookneal shear zone.

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